3. SURFACE FACILITY ALTERNATIVES

The surface facilities of the MGR were divided into two components for this study: waste handling areas, and the balance of plant. Concepts for phased and modular development of facilities in both of these areas were derived from the reference MGR design (DOE 1998d, Volume 2, Section 4.1). The goal of this effort was to design modules that could be easily constructed in phases without having to construct an excessive amount of adjacent future structures. The design of the facility that results from phased development of the modules is similar to the reference design. The primary differences are found in the arrangement of work areas. The arrangement for phased modular development reduces the pool cross-connection capabilities. The reduced capabilities are tolerable with adequate provision for redundant fuel assembly handling equipment and components. Further development of the modular concept during detailed design may restore a significant portion of the reduced flexibility.

Some surface facility alternatives include capabilities for receipt and transfer of SNF to surface storage in addition to the capabilities of the reference MGR design.

This section describes the concepts for the surface facility modules. Estimated module costs are given in 98$. Since construction of the modules could begin as early as 2005, the costs are also given in 05$. The bases for the estimated costs are described in Appendix E.

The impact of modularization on the construction costs of the reference surface facilities is approximately an increase of approximately $100M (98$) or $120M (05$). Modularization also incurs uncertainties in the need for changes in 10 CFR Part 60.41 to allow partial completion of surface facilities at the time when the license to receive and possess waste is granted.

3.1 WASTE HANDLING AREAS

Waste arriving at the MGR is handled in two separate areas: the carrier preparation building (CPB) area and the WHB. Waste that is not emplaced would be stored at an on-site area. These areas are depicted in Figure 3-1. The carrier preparation building area includes the facilities needed for receiving loaded transportation casks and preparing them for entry into the WHB. Modules that could be added in the CPB area to unload transportation casks and transfer their contents to storage are described in Section 3.1.1. These modules would be constructed before any WHB modules. The WHB is remote from the carrier preparation area. The WHB is the facility where waste is removed from casks and prepared for emplacement. It could also be used for transfer of waste to surface storage. WHB modules are described in Section 3.1.2.

3.1.1 Carrier Preparation Building Area Modules

This study includes design alternatives that integrate additional facilities with the facilities in the reference carrier preparation area design. The additional facilities support early receipt of commercial SNF and canisters of naval SNF. All SNF received by the new facilities is placed into surface storage.

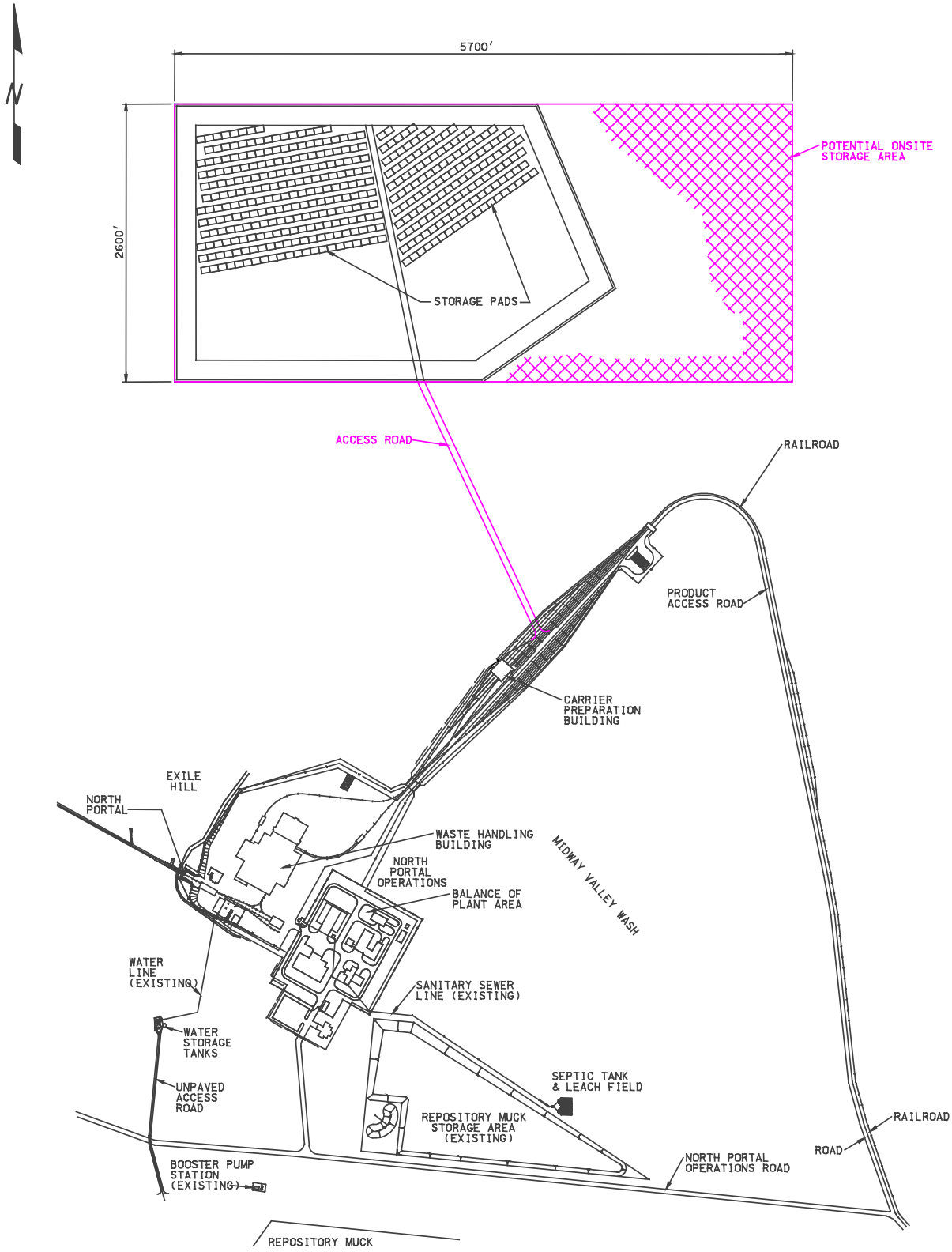

Figure 3-1. Areas where Waste is Received, Handled and Stored

The alternatives for additional facilities include two modules: a canister transfer module and an uncanistered SNF transfer module. The canister transfer module provides transfer of canistered SNF from transportation casks to storage. The uncanistered SNF transfer module provides transfer of uncanistered SNF from transportation casks to surface storage.

3.1.1.1 Canister Transfer Module

The canister transfer module provides transfer of canisters from transportation casks to storage. A conceptual layout is shown in Figure 3-2. It is similar to the canister transfer area in the Topical Safety Analysis Report (TSAR) for a generic CISF (DOE 1997). The module is integrated with the reference MGR CPB. This module is located at the receiving gate of the MGR and is not physically integrated with the WHB.

The canister transfer module also includes a stand-alone dry transfer facility to provide limited recovery capability for SNF in storage. The dry transfer facility design is from the Dry Transfer System (DTS) TSAR (DOE 1996a) that is upgraded to meet generic site seismic requirements of the CISF TSAR.

The costs for this module are estimated to be $128M (98$) or $155M (05$).

3.1.1.2 Uncanistered SNF Transfer Module

This module provides early receipt of limited quantities of uncanistered SNF assemblies on a routine basis using the DTS technology for placement into surface storage. The module is located near the reference CPB. The module can accommodate up to 220 legal weight truck casks per year, for a throughput of 350 to 380 MTHM per year of uncanistered SNF assemblies. The module's capacity to transfer uncanistered SNF from large casks is 75 casks per year. Truck and large cask capacities are described in Appendix B.

The concept for this module is an enhancement to the DTS design. Enhancements to the DTS design include improvements to increase the throughput of the facility and to provide the capability for modular deployment of additional dry transfer capability. Separate inload and outload systems are provided so that transportation casks and storage casks can be processed simultaneously. The size of the DTS transfer room is increased so that SNF can be recovered from one storage cask to another. Cask preparation space is increased, and automated systems, decontamination equipment, remote handling equipment, and additional radiation monitoring equipment are provided to support routine SNF handling operations and to keep radiation exposure as low as is reasonably achievable (ALARA). Structures enclosing the cask preparation areas are changed from sheet metal to concrete in order to provide tornado missile strike protection that is necessary for routine SNF handling operations. The entire DTS structure is upgraded to accommodate the MGR design earthquake. A sheet metal building and a 225-ton overhead bridge crane are provided on the inload side of the DTS for unloading incoming shipments from their transportation carriages and uprighting the casks for processing in the facility.

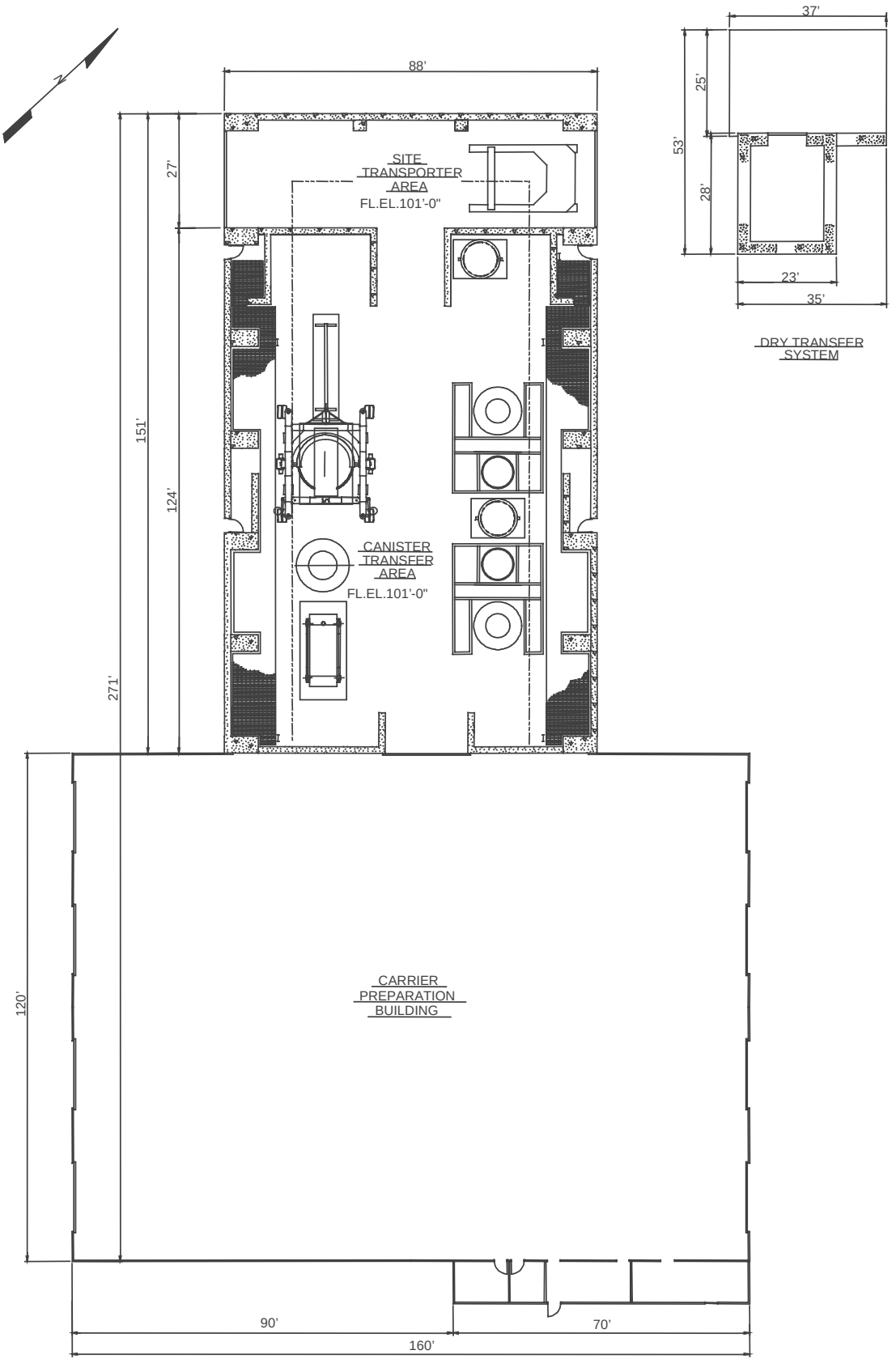

Figure 3-2. Canister Transfer Module

The DTS TSAR design does not include many support function facilities since adjacent reactor facilities are assumed to be available to provide DTS utility and balance of plant needs. For the MGR, however, a significant amount of supporting facilities and activities are needed to support the DTS. These include: site development, utility systems (such as power, water, sewer, and communications), security facilities, and fire protection systems. Other functions necessary to operate the early receipt facilities are provided by contracting for services or by renting facilities. These include administrative support facilities, maintenance shops, medical support facilities, and similar support functions.

The construction costs for the enhanced DTS facilities are $80M (98$) or $97M (05$).

3.1.2 Waste Handling Building Modules

The process areas of the WHB reference design were rearranged to establish an efficient approach to modularization of the building. The resulting rearrangement is shown in Figure 3-3. This arrangement provides the flexibility to: (1) construct facilities for transfer from transportation casks to storage in two modules, (2) construct facilities for placing SNF into disposal containers in two modules, and (3) construct the site-generated waste treatment building as a separate module.

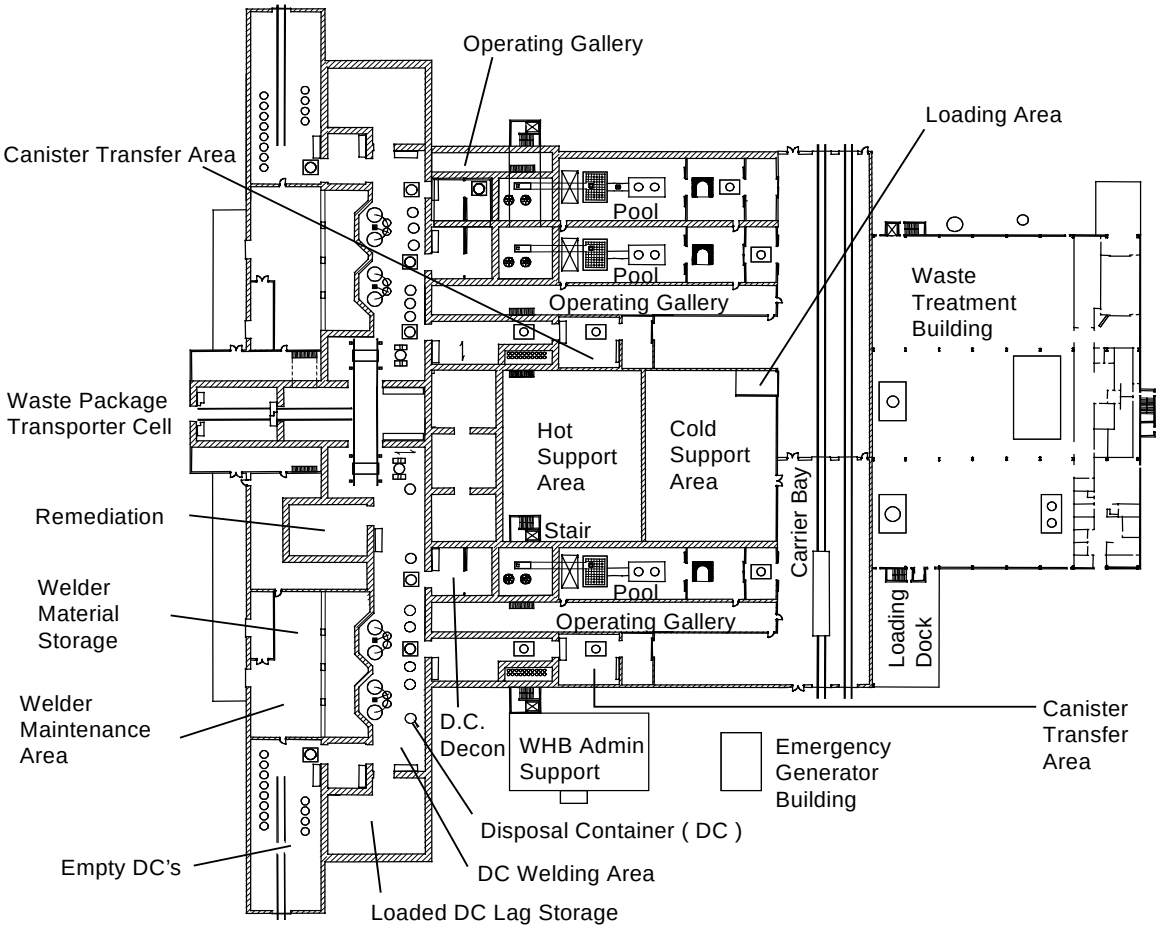

Figure 3-3. Waste Handling Building Configured for Modularization

The modules of the rearranged WHB are illustrated in Figure 3-4. Module WHB-1 is the first increment of the WHB, and it provides receipt capability for bare SNF assemblies and canisters. The module provides transfer of the canistered and uncanistered SNF to storage prior to emplacement. After emplacement begins, SNF is transferred to Module WHB-2 where the SNF is placed into disposal containers. Module WHB-3 provides additional receipt and emplacement capability for uncanistered SNF and canisters. Module WHB-4 provides permanent waste treatment facilities for low level wastes. Module WHB-5 provides additional receipt capability for uncanistered SNF assemblies, if required.

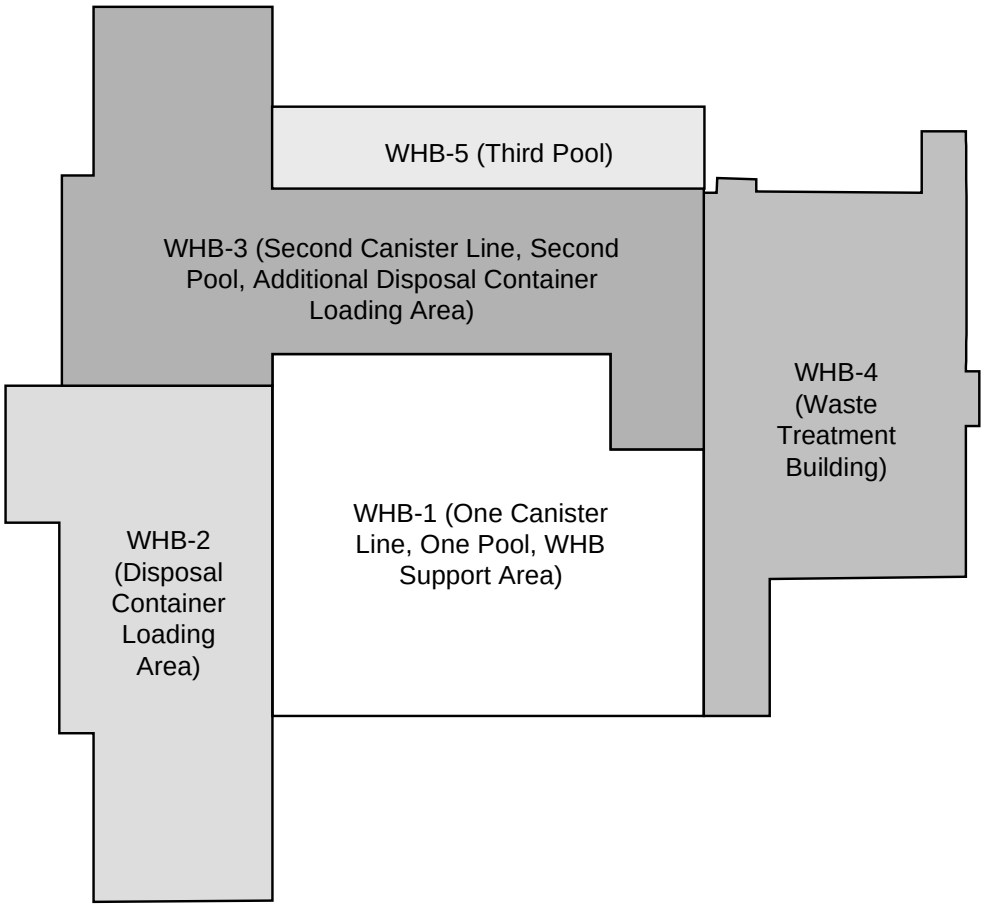

Figure 3-4. Waste Handling Building Modules

The construction of facilities adjacent to operating nuclear facilities requires extensive preplanning to avoid impact on facility operations. This technique has been successfully completed at many nuclear sites, with the first units becoming operational while the other units were still under construction. In the WHB, the structural shells of major structures immediately adjacent (to the important-to-safety operating areas) are constructed early, even if they are not required until later stages of operation. This provides a buffer for ensuring protection of the important-to-safety areas from construction activities. Temporary security devices are installed to separate areas under construction from those in operation. Controlled area fencing is installed in such a manner that construction of additional modules is outside of the controlled area. When construction is completed, the controlled area fence is then moved to incorporate the newly constructed module. Where appropriate, construction cost estimates include a scaling factor to account for the increased costs associated with construction of facilities adjacent to operating waste handling facilities.

The cost estimates for the WHB modules were scaled from documented cost estimates for the reference WHB design as described in Appendix E. Uncertainties in the cost estimates for the modules, therefore, reflect the uncertainties in the cost estimates for the WHB. The ratio between the cost of modular WHB construction and the cost for the reference WHB construction, however, is expected to be insensitive to the uncertainties in the cost estimates.

3.1.2.1 Module Waste Handling Building-1

Module WHB-1 includes one canister transfer area and one pool for transferring uncanistered SNF assemblies. Supporting areas in the WHB are also provided in this module, as well as some north portal balance of plant facilities. Shipments of canistered SNF and uncanistered SNF enter Module WHB-1 via the carrier bay and exit via the same side once they are loaded into storage casks. As such, only the carrier bay side of the WHB will be equipped for handling casks in Module WHB-1.

If the implementation scenario envisions extended high rates of receipt and storage of canisters of SNF, it would be necessary to construct the Module WHB-2 structural concrete shells during the Module WHB-1 construction phase because of the proximity of Module WHB-2 to areas that will be operating in Module WHB-1. Module WHB-1 construction would not have to include the Module WHB-2 structural concrete shells if the canister handling could be restricted to the carrier bay side of the canister transfer area. Figure 3-3 shows the location of the carrier bay and canister transfer area.

Hot and cold support areas are provided with Module WHB-1, but these are not fully equipped until other modules are constructed. The facility arrangement provides for additional floor levels in the hot and cold support areas as needed to accommodate heating, ventilation, and air conditioning (HVAC), piping, electrical, and other equipment. In order to better accommodate modular construction, the access tunnels beneath the reference MGR WHB design were replaced with personnel access corridors above the operating and support areas. Cross transfer corridors were arranged such that they provide top access from the operating areas to contaminated equipment decontamination rooms located in the hot support area.

The canister transfer area can transfer 200 canisters per year to storage. Rates for transfer of uncanistered fuel are 135 large casks per year or 500 truck casks per year. During emplacement operations, SNF can be transferred from large casks containing dual-purpose canisters (DPCs) at a rate of 150 casks per year, or uncanistered SNF can be transferred from truck casks at a rate of 525 casks per year.

The construction costs for Module WHB-1 are estimated to be $490M (98$) or $593M (05$).

3.1.2.2 Augmented Waste Handling Building-1

This option provides the WHB-1 design plus additional canister receipt and transfer facilities that are integrated into the WHB-1 design. This module can continue transfer of canisters to storage after emplacement operations begin. The location of the additional facilities is shown in Figure 3-5.

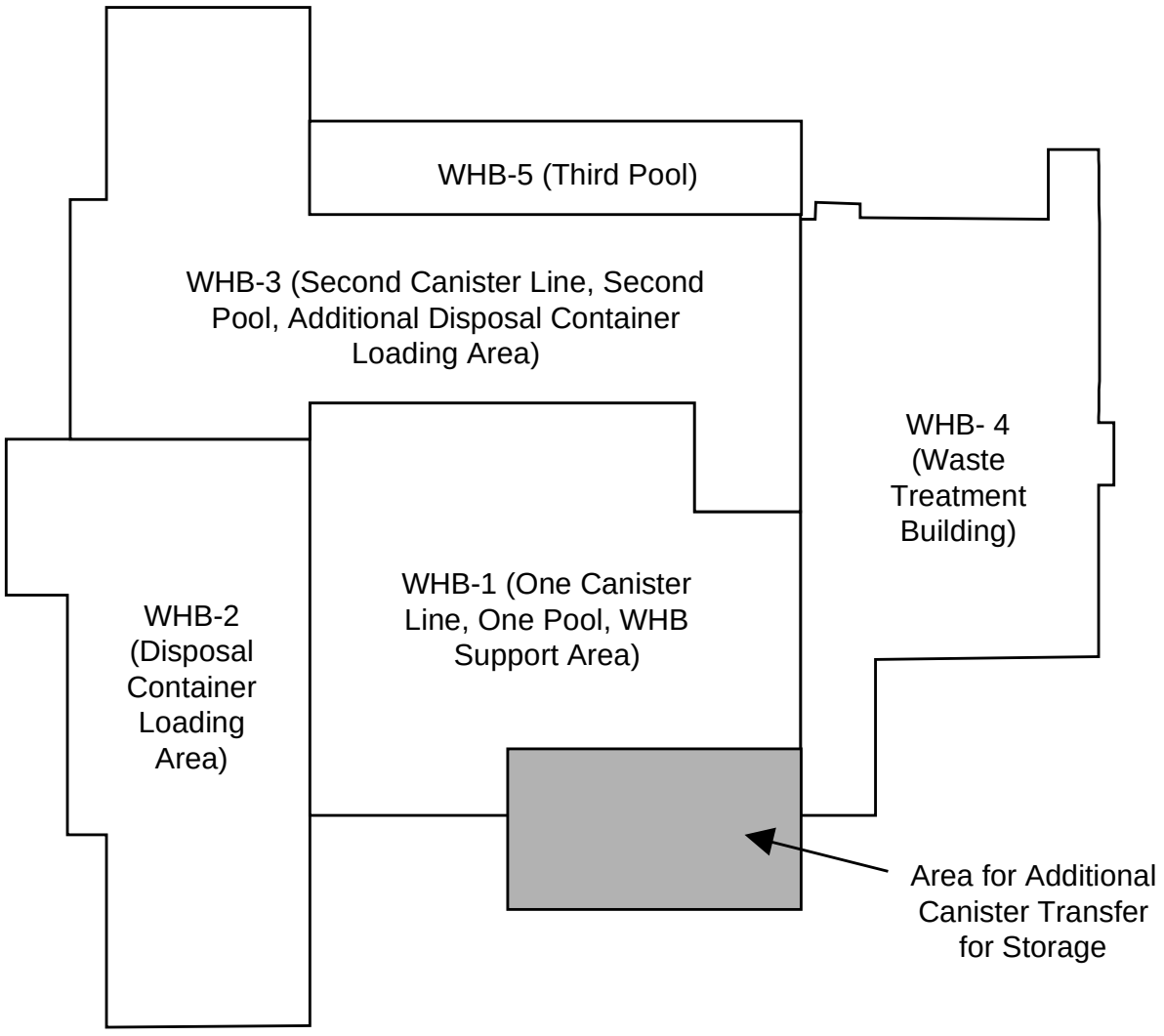

Figure 3-5. Location of Additional Canister Transfer Area

The additional canister transfer area is identical to that described in Section 3.1.1.1. It is integrated with WHB-1 instead of with the carrier preparation area building. Storage cask vendor canister transfer and handling equipment is provided in an enlarged canister transfer area such that canisters can be placed into on-site dry storage outside the WHB.

This option provides the capability to receive up to 800 cask shipments containing canisters annually. Of these, up to 200 casks of high-level waste (with or without immobilized plutonium) can be received and their canisters processed for emplacement. Up to 600 cask shipments (3,000 MTHM/year) can be received and their canisters (DPCs) or multi-purpose canisters (MPCs) processed for storage. No provisions are available for placing canisters of high-level waste with or without immobilized plutonium into storage in this option, though such a storage system could be used at the MGR if it is licensed by the NRC. Receipt and processing of uncanistered SNF is not affected by this option. Uncanistered SNF can be either processed for emplacement or processed for lag storage using the wet transfer pools.

The construction costs for this module are estimated to be $552M (98$) or $668M (05$).

3.1.2.3 Module Waste Handling Building-2

Module WHB-2 includes disposal container loading, closure, and handling areas. Waste package handling, decontamination, and emplacement transporter loading areas are also included in this module. The waste-package-transporter maintenance building is provided. Module WHB-2 equipment would be procured and installed just prior to initial repository emplacement activities.

Together, Modules WHB-1 and WHB-2 provide approximately half of the operational areas of the WHB. They can support emplacement of approximately 1,000-1,500 MTHM commercial SNF, depending on the number of assemblies delivered in each transportation cask. In addition, they can support emplacement of 200 canisters per year.

The construction costs for WHB-2 are estimated to be $126M (98$) or $152M (05$). The costs are $43M (98$) or $52M (05$) for the structural concrete shells that may, in some cases, be included with construction of WHB-1.

3.1.2.4 Module Waste Handling Building-3

Module WHB-3 provides a second canister transfer area and a second pool, along with an additional operating gallery. The carrier bay is also extended. Additional areas are provided for disposal container handling and lid welding, for waste package handling and decontamination, and for emplacement transporter loading. All of these areas and the equipment are identical to those provided in modules WHB-1 and 2. Additional hot and cold support equipment is installed in the support areas previously constructed with Module WHB-1. Additional balance of plant facilities are also provided to support the added receipt and emplacement operations.

The construction costs for WHB-3 are estimated to be $340M (98$) or $411M (05$).

3.1.2.5 Module Waste Handling Building-4

Module WHB-4 provides the Waste Treatment Building. Prior to construction of this module, waste treatment functions are contracted for handling, processing, and disposing of low level wastes created at the MGR. The contractor would provide any temporary facilities needed at the repository.

The construction costs for the waste treatment building are $34M (98$) or $41M (05$). Annual costs for contracting waste treatment functions before this module is constructed are estimated to be $1.8M per year (98$), or $2.1M per year (05$), greater than when the waste treatment building is operating.

3.1.2.6 Module Waste Handling Building-5

Module WHB-5 provides an option to construct a third pool for receiving and handling uncanistered SNF. The carrier bay is also extended with this module. Since the third pool would be adjacent to the second pool, the decision whether or not to add a third pool should be made prior to constructing Module WHB-3. If a third pool is required, the area should be excavated and the structural shell should be completed prior to start of operations in the second pool. Installation of equipment in the third pool area could be delayed until facility throughput requirements dictate its need.

The costs for WHB-5 are estimated to be $42M (98$) or $51M (05$).

3.2 BALANCE OF PLANT

Where practical, construction of a portion of the balance of plant north portal support facilities would be deferred. Deferred balance of plant facilities include: the Administration Building, Motor Pool, Medical Center, the Mockup Building, and the Visitor's Center.

If the balance of plant facilities are deferred, the functions they would have performed are provided by contract services or temporary facilities that are accounted for by including operating and maintenance (O&M) costs for these functions. This approach results in significant cost reductions in the early phases of MGR surface facility construction; however, the approach could introduce a potential for impacting surface facility operations due to contract disputes.

The construction costs for the portion of the balance of plant that can be deferred are estimated to be $133M (98$) or $161M (05$). The O&M costs during the period before they are constructed are estimated to be $8.2M per year (98$), or $9.9M per year (05$), greater than the O&M costs after they are completed.

3.3 CONSTRUCTION SCHEDULE

The construction period for each module is estimated to be 24 months. This represents a reasonable, yet aggressive objective for developing an initial, relatively simple module and incrementally adding functions to the operating facility.